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EXAMINER	
VAN ROY, TOD THOMAS	

ART UNIT	PAPER NUMBER
2828	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/662,086	Applicant(s) KANE ET AL.	
	Examiner Tod T. Van Roy	Art Unit 2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-55 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-21 and 24-55 is/are rejected.

7)☒ Claim(s) 22-23 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2x 09/12/2003.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

Claim 3 objected to because of the following informalities:

Claim 3 is written as depending from claim 4, while it is believed that it should depend from claim 2 and has been examined as such.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-8, 10-12, 21, 25-26, 30-36, and 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler et al. (G. J. Spuhler. R. Paschotta, R. Fluck, B. Braun, M. Moser, G. Zhang. E. Gini and U. Keller, "Experimentally confirmed design guidelines for passively Q-switched microchip lasers using semiconductor saturable absorbers," Journal of the Optical Society of America B, Vol. 16, No. 4, March 1999) in view of Hargis et al. (US 5761227).

With respect to claims 1, 2, and 3, Spuhler teaches A laser apparatus comprising: a Neodymium-doped lasing material (pg.1 col.1-2 para.4-1, Nd:YVO4), wherein the lasing material includes a first-surface that is substantially transparent to a pump radiation and substantially reflective to laser radiation generated by an interaction between the pump radiation and the Neodymium-doped lasing material (fig.8, output coupler allows pump radiation in, 10% lasing out), wherein the lasing material, further having a second surface that transmits at least a portion of the laser radiation (fig.8 left side of lasing material, transmits lasing wavelength to the SESAM); and a passive Q-switch optically coupled to the second surface of the lasing material (fig.8 SESAM); wherein lasing material and Q-switch are configured to produce pulses of the laser radiation; wherein the pulses are characterized by a pulse length of greater than zero and less than about 1.5 nanoseconds and a pulse repetition rate greater than about 100 kHz (table 2). Spuhler does not teach the laser radiation to be characterized by a vacuum wavelength corresponding to an atomic transition from the 4F3/2 level to the

4I9/2 level of Neodymium in the lasing material. Hargis teaches a diode pumped Nd:YVO4 micro laser (col.6 lines 25-27) in which the laser radiation corresponds to an atomic transition from the 4F3/2 level to the 4I9/2 level of Neodymium in the lasing material (abs.). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser/active medium of Spuhler with the atomic transition of Hargis to allow for the room temperature (Hargis, col.4 lines 51-52) production of 912-9-16nm light which can be frequency doubled to produce a "pure" form of blue light (Hargis, col.10 lines 45-51).

With respect to claim 4, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 1 above, and Spuhler further teaches the Neodymium concentration be greater than 1% and less than about 3% (table 1).

With respect to claim 5, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 1 above, and Hargis further teaches the Nd concentration in the lasing material to be about 2% (col.11 lines 54-57). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus with the doping of Hargis in order to optimize pump efficiency while minimizing re-absorption at the 4I9/2 to 4F3/2 levels (Hargis, col.11 lines 60-65).

With respect to claim 6, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 1 above, and Spuhler further teaches the lasing material to be about 100 microns thick (pg.10 para.1).

With respect to claims 7 and 8, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 3 above, and Spuhler further teaches the output

coupler to be on the order of 1% (fig.13 caption). Spuhler does not teach the 1% coupler to be on the surface of the lasing material (it is mobile in this case). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the mobile output coupler (seen in fig.13) with the immobile output coupler of fig.8 to reduce the number of movable system components for increased system stability and reduced need for alignment.

With respect to claim 10, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 1 above, and Spuhler further teaches the Q-switch to include a saturable Bragg reflector (SBR) (fig.6).

With respect to claim 11, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 10 above, and Spuhler further teaches the SBR to include a substrate (fig.6 left side), semiconductor mirror stack having alternating high and low refractive index layers (fig.6 middle), a quantum well stack (fig.6 absorber layer) having between about 3 and about 15 quantum wells (pg.6 para1, 18 quantum wells- which is about 15, see MPEP 2144.05 I- In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990)- speaking of an overlap of ranges), and a dielectric overcoat (fig.6 right side), wherein the semiconductor mirror stack is disposed between the substrate and the quantum wells, and wherein the quantum well stack is disposed between the semiconductor mirror stack and the dielectric overcoat.

With respect to claim 12, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 11 above, but do not teach the SBR to include a buffer

layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to include a buffer layer on the substrate to balance any undue strain effects caused by the mirror growth on the substrate as is well known in the growth of semiconductor layers.

With respect to claim 21, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 11 above, and Spuhler further teaches the SBR to include a dielectric overcoat of layers of SiO_2 and HfO_2 (fig.6).

With respect to claims 25 and 26, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 1 above, including the use of a source of pump radiation (Spuhler, pg.6 col.2 para.3 – diode pumped).

With respect to claims 30 and 31, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 25 above, including the lasing material be of $Nd:YVO_4$ (pg.1 col.1-2 para.4-1).

With respect to claim 32, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 31 above, and Spuhler further teaches the Neodymium concentration be greater than 1% and less than about 3% (table 1).

With respect to claim 33, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 32 above, and Hargis further teaches the Nd concentration in the lasing material to be about 2% (col.11 lines 54-57). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus with the doping of Hargis in order to optimize pump efficiency while minimizing re-absorption at the $^4I_{9/2}$ to $^4F_{3/2}$ levels (Hargis, col.11 lines 60-65).

With respect to claim 34, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 31 above, and Spuhler further teaches the lasing material to be about 100 microns thick (pg.10 para.1).

With respect to claims 35 and 36, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 31 above, and Spuhler further teaches the output coupler to be on the order of 1% (fig.13 caption). Spuhler does not teach the 1% coupler to be on the surface of the lasing material (it is mobile in this case). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the mobile output coupler (seen in fig.13) with the immobile output coupler of fig.8 to reduce the number of movable system components for increased system stability and reduced need for alignment.

With respect to claim 38, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 25 above, and Spuhler further teaches the Q-switch to include a saturable Bragg reflector (SBR) (fig.6).

With respect to claim 39, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 38 above, and Spuhler further teaches the SBR to include a substrate (fig.6 left side), semiconductor mirror stack having alternating high and low refractive index layers (fig.6 middle), a quantum well stack (fig.6 absorber layer) having between about 3 and about 15 quantum wells (pg.6 para1, 18 quantum wells- which is about 15, see MPEP 2144.05 I- In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990)- speaking of an overlap of ranges), and a dielectric overcoat (fig.6 right side), wherein

the semiconductor mirror stack is disposed between the substrate and the quantum wells, and wherein the quantum well stack is disposed between the semiconductor mirror stack and the dielectric overcoat.

Claims 9, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis and further in view of Yin (US 6356578).

With respect to claims 9 and 37, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 8 and 36 above, but do not teach the first surface to transmit about 0.94% (or reflect 99.06%) of laser radiation of the ordinary polarization and about 0.98% (or reflect 99.02%) of laser radiation of the extraordinary polarization. Yin teaches a Nd:YVO4 lasing material (col.6 lines 17-19) which uses a coated (99.75%, which is about 99.06%, and 96% which is about 99.02%, see MPEP 2144.05 II- In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) - stating it is not inventive to discover the optimum or workable ranges by routine experimentation) dichroic mirror to single out a desired polarization (col.3 lines 37-50). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler and Hargis with the polarization coating of Yin in order to eliminate multiple polarizations and allow for easier integration of other optical components.

Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis and further in view of Weingarten et al. (US 6826219).

With respect to claim 13, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 11 above, but do not teach the reflecting layers to reflect at greater than 99.5% at the wavelength of the lasing material. Weingarten teaches a SBR including reflecting layers which reflect at greater than 99.5% (col.8 lines 50-54). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the reflecting layers of Spuhler and Hargis with the amount of reflection of Weingarten in order to allow for reduced light loss, increased reflection back through the absorbing layers, and a more efficient Q-switching process.

With respect to claim 14, Spuhler, Hargis, and Weingarten teach the laser apparatus as outlined in the rejection to claim 13 above, and Spuhler further teaches the high and low refractive index layers to be of GaAs/AlAs (fig.6, x=0,y=1).

With respect to claims 15 and 16, Spuhler, Hargis, and Weingarten teach the laser apparatus as outlined in the rejection to claim 14 above, and Weingarten further teaches the optical thickness of the quantum well stack to be an odd multiple of lambda/4 (col.12, lines 55-56), and the reflective layers to be of a thickness of lambda/4 (col.8 lines 36-49). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the quantum well stack and reflective layers of Spuhler and Hargis with the lambda/4 thicknesses of Weingarten in order to properly align the layers with the high and low points of the electric field as is well known to those in the art (Weingarten, col.8 lines 36-37).

Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis and further in view of Paschotta et al. (US 6735234).

With respect to claim 17, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 11 above, including the quantum well stack containing InGaAs layers (Spuhler, fig.6). Spuhler and Hargis do not teach the quantum well to include GaAsP layers. Paschotta teaches a laser including an SBR that includes both InGaAs and GaAsP layers (col.7 lines 5-25). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the InGaAs quantum well with the GaAsP layers of Paschotta in order to balance the strain on the overall structure (Paschotta, col.7 lines 17-19).

With respect to claim 18, Spuhler, Hargis, and Paschotta teach the laser apparatus as outlined in the rejection to claim 17 above, recalling Hargis's teaching of 914nm light in claim 1, and Spuhler additionally teaches that the bandgap of the absorbing layer can be tailored to a desired wavelength (pg.4 col.2 para.3). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler and Hargis with the correct photoluminescence wavelength of the absorbing region to allow for the Q-switching process to function correctly.

With respect to claim 19, Spuhler, Hargis, and Paschotta teach the laser apparatus as outlined in the rejection to claim 17 above, and Spuhler further teaches the absorbing layer to include 18 quantum wells. Spuhler, Hargis, and Paschotta do not teach the number of quantum wells to be within the 9-12 range. It would have been

obvious to one of ordinary skill in the art at the time of the invention to tailor the number of quantum wells to fit the given application as an optimization of ranges has been shown not to be patentable matter (see MPEP 2144.05 II - In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955) – stating it is not inventive to discover the optimum or workable ranges by routine experimentation)

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis, and further in view of Paschotta and Weingarten.

With respect to claim 20, Spuhler, Hargis, and Paschotta teach the laser apparatus as outlined in the rejection to claim 17 above, but do not teach the thickness of the quantum well stack to be an odd number of lambda/4 wavelengths. Weingarten teaches an SBR including a quantum well stack to be an odd multiple of lambda/4 (col.12, lines 55-56).). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the quantum well stack and reflective layers of Spuhler, Hargis, and Paschotta with the lambda/4 thicknesses of Weingarten in order to properly align the layers with the high and low points of the electric field as is well known to those in the art (Weingarten, col.8 lines 36-37).

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis and further in view of Weingarten et al. (US 6393035).

With respect to claim 24, Spuhler and Hargis teach the laser apparatus outlined in the rejection to claim 3 above, but do not teach the source of pump radiation to be

capable of providing greater than about 400 watts/mm2 to the lasing material. Weingarten '035 teaches a diode pumped Nd doped lasing material wherein the diode provides more than 400 watts/mm2 (col.8 lines 7-29, 2W/(.1mmX.001mm) = 20000 W/mm2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler and Hargis with the high brightness diode of Weingarten '035 to provide higher output coupling of the laser and higher average output powers (Weingarten '035, col.8 lines 26-29).

Claims 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis and further in view of Spuhler et al. (US 2003/0118060).

With respect to claim 27, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 26 above, but do not teach the system to include a lens arrangement. Spuhler '060 teaches a diode pumped lasing material with a lens arrangement comprising: a first (fig.1 #11), second (fig.1 #13) and third lens (fig.1 #14), wherein the first lens reduces the divergence of the pump radiation from the laser diode along a fast axis, wherein the second lens collimates the pump radiation from the first lens, and wherein the third lens focuses the pump radiation from the second lens into the Neodymium-doped lasing material and collimates laser radiation from the Neodymium-doped lasing material. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler and Hargis with the lens arrangement of Spuhler '060 in order to increase the amount of pumping light projected onto the lasing material, and reduce optical losses due to diverging light.

With respect to claim 29, Spuhler, Hargis, and Spuhler '060 teach the laser apparatus as outlined in the rejection to claim 27 above, and Spuhler '060 further teaches the use of a beamsplitter (fig.1 #21). Spuhler '060 does not teach the beam splitter to be located between the second and third lenses. It would have been obvious to one of ordinary skill in the art at the time of the invention to move the beam splitter between the second and third lenses as the beamsplitters function would remain the same, and additionally, a rearrangement of parts has been shown to be unpatentable material (see MPEP 2144.04 VI C - In re Kuhle, 526 F.2d 553, 188 USPQ7 (CCPA 1975) – stating that positioning of an object which would not change the function is not patentable).

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis, and further in view of Spuhler '060 and Weingarten '035.

With respect to claim 28, Spuhler, Hargis, and Spuhler '060 teach the laser apparatus as outlined in the rejection to claim 27 above, but do not teach the pumping laser to be of an intensity greater than 400W/mm2. Weingarten '035 teaches a diode pumped Nd doped lasing material wherein the diode provides more than 400 watts/mm2 (col.8 lines 7-29, 2W/(.1mmX.001mm) = 20000 W/mm2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler, Hargis and Spuhler '060 with the high brightness diode of Weingarten '035 to provide higher output coupling of the laser and higher average output powers (Weingarten '035, col.8 lines 26-29).

Claims 40-47, and 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis and further in view of Kubota et al. (US 2002/0136246).

With respect to claim 40, Spuhler and Hargis teach the laser apparatus as outlined in the rejection to claim 25 above, but do not teach the apparatus to include a Nd doped cladding pumped fiber device, or an optical harmonic generator coupled to the fiber device for increasing a frequency of the radiation to produce blue light. Kubota teaches a Nd doped fiber amplifier ([0062-0063]) that is cladding pumped (fig.5), and an optical harmonic generator coupled to the device for increasing a frequency of the radiation to produce blue light ([0096]). It would have been obvious to one of ordinary skill in the art to combine the laser apparatus of Spuhler and Hargis with the fiber based blue light generating system of Kubota in order to amplify and transport the 914nm light in the fibers, and produce amplified and directed "pure" blue light within a compact system.

With respect to claims 41 and 42, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 40 above, including the lasing material be of Nd:YVO4 (Spuhler, pg.1 col.1-2 para.4-1).

With respect to claim 43, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 42 above, and Spuhler further teaches the Neodymium concentration be greater than 1% and less than about 3% (table 1).

With respect to claim 44, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 43 above, and Hargis further teaches the Nd concentration in the lasing material to be about 2% (col.11 lines 54-57). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus with the doping of Hargis in order to optimize pump efficiency while minimizing re-absorption at the 4I9/2 to 4F3/2 levels (Hargis, col.11 lines 60-65).

With respect to claim 45, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 42 above, and Spuhler further teaches the lasing material to be about 100 microns thick (pg.10 para.1).

With respect to claims 46 and 47, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 42 above, and Spuhler further teaches the output coupler to be on the order of 1% (fig.13 caption). Spuhler does not teach the 1% coupler to be on the surface of the lasing material (it is mobile in this case). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the mobile output coupler (seen in fig.13) with the immobile output coupler of fig.8 to reduce the number of movable system components for increased system stability and reduced need for alignment.

With respect to claim 49, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 40 above, and Spuhler further teaches the Q-switch to include a saturable Bragg reflector (SBR) (fig.6).

With respect to claim 50, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 49 above, and Spuhler further teaches the SBR to

include a substrate (fig.6 left side), semiconductor mirror stack having alternating high and low refractive index layers (fig.6 middle), a quantum well stack (fig.6 absorber layer) having between about 3 and about 15 quantum wells (pg.6 para1, 18 quantum wells- which is about 15, see MPEP 2144.05 I- In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990)- speaking of an overlap of ranges), and a dielectric overcoat (fig.6 right side), wherein the semiconductor mirror stack is disposed between the substrate and the quantum wells, and wherein the quantum well stack is disposed between the semiconductor mirror stack and the dielectric overcoat.

With respect to claim 51, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 40 above, including the use of a source of pump radiation (Spuhler, pg.6 col.2 para.3 – diode pumped).

Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis, and further in view of Kubota and Yin.

With respect to claim 48, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 47 above, but do not teach the first surface to transmit about 0.94% (or reflect 99.06%) of laser radiation of the ordinary polarization and about 0.98% (or reflect 99.02%) of laser radiation of the extraordinary polarization. Yin teaches a Nd:YVO4 lasing material (col.6 lines 17-19) which uses a coated (99.75%, which is about 99.06%, and 96% which is about 99.02%, see MPEP 2144.05 II- In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) - stating it is not

inventive to discover the optimum or workable ranges by routine experimentation) dichroic mirror to single out a desired polarization (col.3 lines 37-50). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler, Hargis, and Kubota with the polarization coating of Yin in order to eliminate multiple polarizations and allow for easier integration of other optical components.

Claims 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis, and further in view of Kubota and Spuhler '060.

With respect to claim 52, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 51 above, but do not teach the system to include a lens arrangement. Spuhler '060 teaches a diode pumped lasing material with a lens arrangement comprising: a first (fig.1 #11), second (fig.1 #13) and third lens (fig.1 #14), wherein the first lens reduces the divergence of the pump radiation from the laser diode along a fast axis, wherein the second lens collimates the pump radiation from the first lens, and wherein the third lens focuses the pump radiation from the second lens into the Neodymium-doped lasing material and collimates laser radiation from the Neodymium-doped lasing material. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler, Hargis, and Kubota with the lens arrangement of Spuhler '060 in order to increase the amount of pumping light projected onto the lasing material, and reduce optical losses due to diverging light.

With respect to claim 54, Spuhler, Hargis, Kubota and Spuhler '060 teach the laser apparatus as outlined in the rejection to claim 52 above, and Spuhler '060 further teaches the use of a beamsplitter (fig.1 #21). Spuhler '060 does not teach the beam splitter to be located between the second and third lenses. It would have been obvious to one of ordinary skill in the art at the time of the invention to move the beam splitter between the second and third lenses as the beamsplitters function would remain the same, and additionally, a rearrangement of parts has been shown to be unpatentable material (see MPEP 2144.04 VI C - In re Kuhle, 526 F.2d 553, 188 USPQ7 (CCPA 1975) – stating that positioning of an object which would not change the function is not patentable).

Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis, and further in view of Kubota, Spuhler'060 and Weingarten '035.

With respect to claim 53, Spuhler, Hargis, Kubota, and Spuhler '060 teach the laser apparatus as outlined in the rejection to claim 52 above, but do not teach the pumping laser to be of an intensity greater than 400W/mm2. Weingarten '035 teaches a diode pumped Nd doped lasing material wherein the diode provides more than 400 watts/mm2 (col.8 lines 7-29, 2W/(.1mmX.001mm) = 20000 W/mm2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the laser apparatus of Spuhler, Hargis, Kubota, and Spuhler '060 with the high brightness diode of Weingarten '035 to provide higher output coupling of the laser and higher average output powers (Weingarten '035, col.8 lines 26-29).

Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spuhler in view of Hargis, and further in view of Kubota and Moulton (US 5740190).

With respect to claim 55, Spuhler, Hargis, and Kubota teach the laser apparatus as outlined in the rejection to claim 40 above, but do not teach the apparatus to comprise a light source producing two or more colors including blue light, a modulating means optically coupled to the light source, and a scanning means for forming an image. Moulton teaches a display system comprising a light source producing two or more colors including blue light (col.2 lines 43-46), a modulating means optically coupled to the light source (col.2 lines 59-60), and a scanning means for forming an image (col.2 lines 59-62). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the Q-switched 914nm amplified and steered light of Spuhler, Hargis and Kubota with the multi-colored, modulation, and scanning means of Moulton to produce large, easily viewable images in the presence of a high level of ambient light (Moulton, col.1 lines 10-19).

Allowable Subject Matter

Claims 22-23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 22-23 are believed to be allowable based on the fact that the reflectivity values of the dielectric coating placed on the SBR found in the diode-pumped, Q-switched system was not found to be taught in the prior art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned.is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR

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PRIMARY EXAMINER